Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Part 15 regarding new	)	ET Docket No. 04-37
requirements and measurement	)	
guidelines for Access Broadband over	)	
Power Line Systems	)	

REPLY COMMENTS ON NOTICE OF PROPOSED RULE MAKING

To The Commission:

I have a B.S. in electrical engineering, have in the past worked for a power and distribution transformer manufacturer, a manufacturer of amateur radio equipment, and a manufacturer of test equipment making in-house semiconductor IC's, and I've been chief engineer for a couple AM radio stations while holding a First Class Radiotelephone license. I have held an amateur radio license for over forty years, of the extra class for thirty. I've published articles in two ham radio magazines and one company newsletter. I've had my share of experience on the ham bands including Worked-All-States (WAS) and Worked-All-Continents (WAC) certificates using no more than five watts output from or ten watts input into my transmitter, many evenings operating HF portable in the parks, and pedestrian mobile on ten meters. I have come across and dealt with various noise and interference problems from Part 15 devices which I've either solved, compromised with, or moved away from.

My reply comments here on National Telecommunications and Information Agency Report 04-413[1] phase 1, and NTIA comments on the NPRM, are general enough that I shall merely summarize the issues I am addressing, and for convenience quote from *QST*, the publication of the national organization of radio amateurs——ARRL——, and another journal.

> Directly contradicting the FCC's claims in the BPL Notice of Proposed Rule Making that "the risk of harmful interference from Access BPL operations is low," the NTIA found that interference is "likely" to receivers trying to hear "low to moderate" signal levels extending to 75 meters (about 250 feet) for land vehicles and 460 meters (¼ mile) for fixed stations. Land vehicles are nearly always within 250 feet of a power line——and needless to say, most fixed stations are within ¼ mile of a power line. ... Yet the NTIA does not take the logical next step of recommending a lower

[1] http://www.ntia.doc.gov/ntiahome/fccfilings/2004/bpl/

limit for BPL radiation. Instead the Phase 1 study suggests "several means by which BPL interference can be prevented should it occur." ...

In a May 17 speech, NTIA Acting Assistant Secretary Michael D. Gallagher said the Phase 1 study "showed that interference risks are high under existing FCC Part 15 rules." However, he also claimed that "solutions exist to all identified BPL technical issues." This is true only if turning BPL systems off, and leaving them off, is counted as a "solution." We doubt that investors in BPL would regard that as a desirable outcome.[2]

The FCC is now studying the National Telecommunications and Information Agency report on BPL. And while the glowing press release put out by NTIA touted the possibilities of BPL, the technical data in the report presents another picture. And that picture is anything but fuzzy. NTIA cites major interference concerns and suggests methods used to measure BPL interference are inadequate.[3]

The league also took the FCC to task for its willingness to balance BPL's presumed benefits against the potential of harmful interference. "*The principal obligation of the Commission in permitting unlicensed devices or systems is to establish a radiation emission level that is sufficiently low that by their operation they will predictably not interfere with licensed radio services*," the ARRL emphasized.

...

Among interference mitigation techniques, the NTIA study recommends reducing BPL device output power——which it called "the single most effective method" of reducing interference potential——and "shifting or notching" BPL frequencies.[4]

Bush told the Minneapolis gathering that there need to be technical standards to enable new broadband technologies such as high-speed communication over power lines. "power lines can be used for broadband technology," Bush said. "So the technical standards need to be changed to encourage that."

"Once deployed," the president declared, "BPL has the potential to turn every electrical outlet into a broadband pipeline." Bush also suggested that BPL could supply broadband services to rural dwellers, a prospect that the League and others contend is not economically feasible.[5]

---

2 "It Seems to Us," *QST*, July, 2004, p. 9.

3 "More on BPL," *WorldRadio*, July, 2004, p. 64.

4 "Happenings," *QST*, July, 2004, p. 73.

5 Ibid., p. 74.

The line I am taking in these reply comments is this: The NTIA is beholden to the president, to implement his policies, as well as to protect government frequencies. President Bush's characterization of BPL having "the potential to turn every electrical outlet into a broadband pipeline" is that of a supertechnology. A country's leader touting a supertechnology has the effect of causing it's scientists to stretch themselves to try to achieve what ordinarily would be considered impractical, in this case to send wideband HF (to low VHF) over effective antennas without causing harmful interference to the many radio services trying to receive weak to moderate to strong signals in the same vicinity.

A promoted supertechnology does not have to actually succeed in order to produce benefits. With no intent of disparaging my country by the following analogy, Hitler's boast of upcoming superweapons in 1944 was a boost to the morale of the flagging German citizenry irrespective of whether they actually had any online. I seriously doubt whether any rural farmer in America will ever see BPL available to him——the costs of the infrastructure to bring it to him outweigh any revenue generated in a sparse population——, but the announced *possibility* shows that America is on the move and is an encouragement to business in general.

I am asking for your indulgence here as I recite a (fictional) story in another arena to give some applicable illustrations of this dynamic of scientists stretching their technology.

> Diebner had thrown the switch leading to an unknown world, and there were no maps to guide their journey. He had pulled the cork on an all-powerful genie who might not be obedient to their commands, who might not even understand their language. And if it did obey, whose orders would it follow? Hitler's? Himmler's? All the consequences were terrifying.
>
> "We have neutron activity."
>
> It was Lauderbach, giving the words to the first movements of a needle.
>
> Anders nodded. It was simply the activity of the energized neutron source. Nothing was yet happening within the dead stillness of the graphite. But soon the self-destruction would begin.
>
> It had to fail. No matter what the dangers of the meltdown, nothing could be as destructive as its success. give the Nazis the plutonium for their bombs and there would be a hundred meltdowns.
>
> "It's rising."
>
> Diebner's voice had an edge of fear as he pointed an unsteady finger toward the gauge. He looked toward Anders, waiting for the next step. Anders did nothing. A simple tip of his chin acknowledged a result he clearly expected.
>
> "The control rods," Diebner nearly begged.
>
> "Not yet," Anders said.
>
> The level of the needle indicated that fission had begun. Deep within the pile, unstable uranium atoms were shattering, firing off neutron bullets that were splitting other atoms.
>
> Werner Heisenberg recognized the moment from his own test reactor. There was a reaction, but it was not yet self-

sustaining. If they turned off the emitter, the needle would quiver and then settle back. He knew that Nils Bergman still had time to cancel the test. If his colleague had any flicker of doubt, this was the time for him to act. But all he could read in Bergman's eyes was icy determination. The man was going on.

"It's accelerating," Lauderbach announced. The rate of increase in fission activity was beginning to rise. Now the neutrons produced by the explosion of atoms were outnumbering those produced by the controllable emitter.

"It's running. It's self-sustaining," Diebner shouted.

Anders nodded. "Just a few more second," he said.

Diebner's hand reached toward the switch. His eyes darted toward Anders for instruction.

"All right," Anders advised. Instantly, Diebner threw the toggle.

The gauges never faltered. The needles kept climbing.

"We're showing a temperature rise," Heisenberg advised calmly. "It's up to eighty degrees."

There was no response from Anders.

"The reaction is still increasing," Lauderbach reported.

"Ninety degrees," Heisenberg observed, watching the rapid rise in the water temperature.

Anders touched a button. From overhead, the clattering sound of the pulleys responded. The cadmium control rods began lowering into their channels, absorbing neutrons and slowing the chain reaction. He released the button when the rods had dropped a third of their length into the graphite.

"One hundred ten degrees," Heisenberg intoned.

Diebner suddenly looked frantic. "It's running too fast."

Again Anders pushed the control rod button. The rods dropped further into the pile.

"The reaction is still accelerating," Lauderbach shouted. He, too, was beginning to show panic.

Heisenberg's reports were now coming more quickly. "One hundred thirty," he snapped.

The scientists knew that Bergman was working to achieve a delicate balance. The cadmium control rods had to absorb just enough neutrons to stabilize the speed of the reaction. A constant number of neutrons had to be allowed to reach their uranium atom targets, splitting them to release the same number of neutrons. And at that level of activity, the cooling water flow had to be sufficient to carry off the heat that the reaction generated. Both parameters seemed to be failing. The reaction was accelerating, and the water temperature continued to climb toward its boiling point.

"One hundred fifty degrees," Heisenberg announced.

Anders responded by once again pressing the button. The control rods lowered farther into the graphite blocks. Involuntarily, some of the scientists began backing away from the control console.

"It's slowing," Diebner shouted hopefully. The needle indicating the rate of the reaction was still climbing, but its speed across the face of the dial was lessening. Anders flashed a hair-trigger smile. All his calculations had indicated that the reactor would stabilize itself, and all the work of his colleagues had come to the same conclusion. His test was proceeding exactly on schedule.

"One seventy-five," Heisenberg said of the water temperature. Anders shifted nervously. This was to be the reactor's downfall. The heat that had amazed Heisenberg would continue to climb until the cooling water would prove inadequate.

"It's stable," Diebner gasped. "It's stable. We have complete control of the reaction." Some of the Germans shouted for joy. But others were becoming aware that the water temperature was still rising. Their margin of safety was being cooked away.

"One ninety," Heisenberg said. Now there was an edge of nervousness in his voice. He looked at Bergman, although he understood that there was nothing that the Swedish genius could do. The reaction was stabilized. The control rods were nearly fully inserted. There was no time to begin pulling the fuel rods. And the radiation danger of such an emergency procedure was incalculable.

Anders had reached the moment. In the next twenty seconds, the water temperature would slip past the boiling point. Its ability to carry off heat would be diminished. He would close the control rods to their full effectiveness. The rate of fission would begin to drop, but not quickly enough to compensate for the loss of coolant. Nazi hopes for a superweapon, like the graphite in the pile, would begin to burn away.

"Two hundred," Heisenberg said.

"There's not enough water," Diebner understood. Now he began backing slowly away from the controls.

Anders stretched his fingers toward the control button. He was about to announce a shutdown. The test was a failure. But only he knew how catastrophic the failure would be.

"Wait!" the command came from Heisenberg.

He and Anders were the only ones left leaning over the control console. Heisenberg was staring at the water temperature dial, holding one hand in the air as if to block and action by Anders.

"I think we may be all right, Professor Bergman," Heisenberg said cautiously. Anders slipped along the console until he was pressing against Heisenberg. He could see the water temperature gauge hesitating near the boiling mark.

"Too close," Anders said. "We should begin shutdown."

Heisenberg shook his head. "Look, it's in balance. It's right on the edge, but it's in balance."

Anders ran his eyes quickly over the dials. The rate of fission was steady. The water temperature was holding just a few degrees below boiling.

"At this rate of water flow," Heisenberg said, "you could sustain the reaction for a year."

"There's no safety margin," Anders cautioned. But once again Heisenberg's hand was in the air.

"Just another minute. All we need is enough time to measure the conversion rate. Then we'll be able to check the plutonium yield figures."

Lauderbach led his colleagues in step back to the console.

"It's a success," he whispered.

Anders was stunned. His reactor was running perfectly.

Diebner began to scream with delight. "We've done it! We've done it!" He rushed to Anders. "Professor Bergman, you've done it! A chain reaction. The first ever."

Anders looked past Diebner. "Another minute," he said to Heisenberg. "Any change in the flow rate ..."

Heisenberg nodded his agreement. They were flirting with disaster. Even a momentary fluctuation in the water pressure could send the heat soaring. But the longer they let it run, the more information they would have for the production reactor.

They all stood in silence. Once again, the only sound was the humming of the electric pumps. The seconds slipped by with all the needles steady in their gauges.

There was nothing that Anders could do. To avoid suspicion he had kept all his calculations as close to legitimate values as possible. He had counted on the runaway heat that Heisenberg had experienced to do the damage. And that heat had failed him by only a few degrees. But that was enough. His design was a success. And with the experience he had gathered, there would be even more safety margins built into the production system.

He had given the Germans their bomb.[6]

Let's look at some applications to the above analogy. "Diebner had thrown the switch leading to an unknown world, and there were no maps to guide their journey. He had pulled the cork on an all-powerful genie who might not be obedient to their commands, who might not even understand their language. And if it did obey, whose orders would it follow? Hitler's? Himmler's? All the consequences were terrifying." Yes, BPL is unproven, unknown territory. Allowing it is letting the genie out of the bottle that can't easily be put back in. Once a community(ies) is dependent on BPL——rather than some other platform which would have been every bit as cheap——, they might not want to go along with a Part 15 requirement to shut it down.

The genie "might not even understand their language." BPL signals are not in any understandable language radiated over the air for a radio listener to identify, and someone like, say, a short wave listener, who receives only, has no way over the air to let the BPL service know that he requires certain frequencies to be clear.

"And if it did obey, whose orders would it follow?" Even if we had a handle on the

[6] William P. Kennedy, The Himmler Equation (New York: St. Martin's Press, 1989) pp. 171-5.

technology, who would control it? According to PUBLIC LAW 103-408 [S.J. Res. 90], "(3) reasonable accommodation should be made for the effective operation of amateur radio from residences, private vehicles and public areas, and that regulation at all levels of government should facilitate and encourage amateur radio operation as a public benefit." Okay, what's to be considered "reasonable accommodation"? We are thankful for NTIA's Report 04-413 with its cover letter of April 27, that lists "Other reasonable mitigation techniques suggested in the NTIA Report ..." Other reasonable mitigation techniques. Before the list of the *other* ones, what was the *first* one? Oh yes, "Part of NTIA's proposed solution is to protect 41 frequencies for the most sensitive and likely most severely affected federal systems. Protecting these frequencies, which represent less than 6 percent of the frequency capacity of BPL systems, will go a long way toward addressing potentially serious interference concerns..". If a primary reasonable mitigation technique was to protect certain frequencies, and reasonable accommodation is to be made to amateurs——[S.J. Res. 90], declaration (3)——, then sensitive amateur frequencies need to be protected too.

Shortwave broadcasting has its own treaty obligations the FCC should be honoring. ITU Radio Regulation 4.11 reads: "Member States recognize that among frequencies which have long-distance propagation characteristics, those in the bands between 5 and 30 MHz are particularly useful for long-distance communications; they agree to make every possible effort to reserve these bands for such communications. Whenever frequencies in these bands are used for short-range or medium-distance communications, the minimum power necessary shall be employed." ITU Radio Regulation 15.12 reads, "Administrations shall take all practicable and necessary steps to ensure that the operation of electrical apparatus or installations of any kind, including power and telecommunication distribution networks, but excluding equipment used for industrial, scientific and medical applications, does not cause harmful interference to a radiocommunication service and, in particular, to a radionavigation or any other safety service operating in accordance with the provisions of these Regulations." ITU regulations allocate certain frequencies between 2 and 26 Megahertz for the exclusive use of international broadcasters.

As I read the law here, BPL should be prohibited from operation on amateur and international shortwave broadcasting frequencies. Is that the law that is going to be followed? Or is it going to be some overworked bureaucrat at the FCC deciding limits on required BPL interference mitigation, and what constitutes a critical frequency use? We Americans do not like tyrants giving out the orders. "Hitler's? Himmler's?" That's why we have the form of government we do, and we expect the laws enacted by Congress and the treaties they signed to be honored rather than some official on his own deciding what we should do.

Let's get down to brass tacks. President Bush's speech at a community college in Minnesota would tend to focus our attention on the educational aspects of broadband service. This I will not deny. However, a lion's share of internet use is to convey pornography and video games. A BPL service might be hard pressed to make a profit in the first place, and without those two uses they definitely would not.

Okay, pornography is not hard to find on the internet. I found some without trying. I tried to look up the subject of circumcision by a search engine without the mature-content filter in place, and I got stuff you wouldn't believe. It would be a piece of cake for

an unsupervised youngster to get into it.

Video games. I observed a kid in the library playing a video game, moving the mouse with his fingers to control his action-character running and jumping through a field of grass. Personally, I would be happier to see a kid himself running and jumping through the grass, exercising his whole body, rather than just three fingers for an hour.

Okay, maybe there is some value in the eye-hand coordination he is learning, and maybe freedom of expression is valuable enough that we should allow pornography. But what happens when another kid is doing some really beneficial activity like shortwave listening or ham radio, and a couple other kids down the block want to do pornography and video games? If those two are doing it via BPL, they could well be interfering with that first kid. Well, that's why we have the laws, mentioned above, to keep BPL off such frequencies. But if the FCC bureaucrat is deciding on his own initiative how much mitigation to require, he is probably using some other criteria than the health of those young people to make his decision, and that is why Americans in the know would probably consider him to be on the order of a tyrant.

And finally, with the genie loose, "All the consequences were terrifying." The average Joe has certain fears after the advent of nuclear energy that he was not affected by beforehand. Similarly BPL technology just produces new concerns to the shortwave radio user that he didn't used to have.

Okay, so we're going ahead with our supertechnology. Playing so with the laws of physics will often involve a mad balancing act. The uranium fuel rods are inserted into the graphite, an emitter source of neutrons is directed inward, slowed down by the graphite to allow collision with more nuclei in the fuel, and when a chain reaction develops, cadmium control rods are inserted to absorb excess neutrons to keep the reaction in balance. So control is largely a matter of balancing the fuel rods with the control rods.

And yet there is another factor that the physicists would do well to figure into their calculations. The cooling water should be kept below the boiling point. What happens if it turns to steam is really really bad.

The NTIA study came up with its own mad balancing act, surprise, surprise. They speculate that replacing aging power line hardware with BPL hardware may in some cases reduce the noise endemic to power lines, so that at times of the day when the BPL system is not in use but when the interfering noise from the power lines is ordinarily most intense, the radio user may actually see a reduction in the interference he has to put up with. To be sure the NTIA doesn't see this as an exact tradeoff, but only as a marginal benefit. My comment is that there is a crucial element in the tradeoff the NTIA seems to have ignored.

I had some power line noise near my station, severe during the hot day, that I called my power company to complain about. They sent their interference guy out to look at the pole, and then they issued a work order, and the linemen came out and took care of the problem——not as quick as I would have liked, but at least they got the job done. Well, I got to talking to the interference troubleshooter when he was out here, and he said that his job had been made more difficult when they laid off his helper in a cost saving move. It really is a job for two, and now he does it all by himself. I asked him what would happen if BPL came to our town. He told me that his workload as a result of BPL would be so heavy, that he would just retire at that point.

That would be sort of like that cooling water turning to steam, if the interference

troubleshooter up and quits——poof!——, then we're going to be in a bad way irrespective of any balance between the interference factors. A self-sustaining reactor just goes on to explode, and the powerline-radiated interference would just overwhelm the community's radio listeners.

The remaining of my comments have to do with the applicability of NTIA's proposed interference mitigation techniques to a prototype system as opposed to the rolled-out system. From what I understand all of our BPL systems until now have been some kind of test setups, with the exception of Manassas, Virginia service, but BPL is on the verge of coming into its own, as indicated by the rationale for not extending the reply-comment period any longer than June 22nd, so as not to leave BPL in regulatory uncertainty.

Presidential Decision Directive-63 (PDD-63) states that "All critical infrastructure protection plans and actions shall take into consideration the needs, activities and responsibilities of ... first responders." This cooperation was to be part of a scheme in place not later than five years from the day the president signed PDD-63, which would make the deadline May 22, 2003, shortly after your NOI 03-104 came out. Virtually all the comments from BPL companies were submitted after that date, and they seemed to show a sad lack of cooperation. At the very least these prototype systems should have had what "among interference mitigation techniques, the NTIA study recommends reducing BPL device output power——which it called 'the single most effective method' of reducing interference potential——and 'shifting or notching' BPL frequencies."[7] It was only HomePlug an in-house BPL system that routinely notches amateur frequencies, and now as I understand it so does the system in Manassas. The BPL companies' comments on NOI 03-104 instead of showing them implementing the basic procedures of cooperation recommended by NTIA, patently denied that harmful interference could occur. Such denials are all too typically associated with supertechnologies.

> They were decent men. Ask any one of them to design a furnace in which a whole generation could be murdered, and he would recoil in horror. But ask him to calculate the exact temperature at which a human body would vaporize and he would rush to be the first with the calculation. Ask one of them to build a bomb that could flash an entire city into fire and he would become enraged at the suggestion. But ask him to create an element that would release the energy of the sun and he would labor day and night. They could leave their Christmas tree to watch the first atomic bomb explode over London. And then they could return to their carols in celebration of the precision with which they had been able to calculate its heat.[8]

As far as I know some, and perhaps all, of the BPL companies' engineers are decent men who would never dream of designing a system which would blanket the airwaves with outrageous amounts of interference. The engineer who was quoted in the comments

---

[7] "Happenings," *QST*, July, 2004, p. 73.

[8] Kennedy, p. 230.

from Manassas, Virginia expressed his interest in the preservation of the radio spectrum's uses, and I have no reason to doubt him. In fact, I do believe he incorporated HomePlug's standard of notching ham frequencies in the design.

Other engineers seem to not have in theirs which is why the ARRL reports fourteen or so unresolved BPL interference issues around the country. A propensity toward denial of unwanted results goes a long way to explain the differences in opinions about the interference potential of BPL. It's not that interference is not likely, as the well-done NTIA study puts that issue at rest.

I do not disagree with NTIA's suggested interference mitigation ideas. I just think they should have *already*——at least the main ones——been incorporated into the prototype testing and seen light of day in the responses to the NOI 03-104. When we get to the roll-out of BPL in earnest, we need to be refining those tested precautions. As my analogous example put it, "His design was a success. And with the experience he had gathered, there would be even more safety margins built into the production system." I want to go on to suggesting the additional safety margins that should be built into BPL systems besides what the NTIA report suggests which in their case should have been tried a lot earlier. I am not saying they won't work——maybe they will just dandy——only that we have to take them more on faith than if they'd been employed earlier.

First of all, with massive BPL roll-out and the *likely* mysterious interfering signals that will emanate from power lines all over the place in proximity to all kinds of radio services, BPL signals must be required to employ a periodic identification tag easily recognizable (Morse code?). I suggest bands of at least 100 KHz identified in blocks with unique identifiers changed on a nightly basis, so that if someone reports it, the presumption is that it's an interference problem that automatically gets rectified——for that block——until the midnight i.d. change.

Secondly, I suggest a telephone hotline number where besides the automatic daily mitigation of intercepted BPL interfering signals, a person can enter in a particular frequency to be cleared (with suitable bandwidth: +/- 10 KHz) for the same period of time to be automatically cleared as long as caller i.d. of the phone number recognizes the call as originating from the service area. I suggest a closed loop deadman's switch which will shut down the whole BPL system if the hotline phone lines go down.

And because in a nationwide roll-out, with interference likely, there is bound to be, sooner or later, interference to emergency communications, there needs to be a tight time limit on the above mitigation technique so that if the interfering frequency or block cannot be notched out within ten minutes, the BPL use must shut down for the day.

In summary, although I do not relish the idea of BPL——I think there are better alternatives——,I am in general agreement with the NTIA's interference mitigation suggestions except that the balancing act between power line noise and BPL emissions seems to have neglected the interference troubleshooter who will likely be too overwhelmed by the added BPL sources to effectively do his job. I don't think the NTIA suggestions go far enough, and that they should have already been tried by the BPL companies who are so eager to promote homeland security, when they did their prototype work commented on in the NOI. In addition to the NTIA suggestions, I believe BPL providers should be required to impose a Morse i.d. on their signals, and that an effective telephone hotline for *automatically* mitigating interference should be required as I specified

above. Amateur and shortwave frequencies should be included in the protected category along with NTIA's 41.

Respectfully Submitted,
Earl S. Gosnell III